What is Claimed:

1. A method for desalinating a solution containing sparingly soluble solutes comprising the steps of:

(a) introducing a solution having sparingly soluble solutes and nucleation crystals to the high pressure side of a first semi-permeable membrane barrier to produce a retentate stream on the high pressure side of the first semi-permeable membrane barrier, and a permeate stream on the low pressure side of the first semi-permeable membrane barrier having reduced concentrations of the sparingly soluble solutes;

(b) introducing the permeate stream produced in step (a) to the high pressure side of a second semi-permeable membrane barrier to produce a second retentate stream on the high pressure side of the second semi-permeable membrane barrier, and a product stream on the low pressure side of the second semi-permeable membrane barrier with substantially lower concentrations of sparingly soluble and soluble solutes compared to the solution initially introduced in step (a); and

(c) returning a majority fraction of the retentate stream rejected by the first semi-permeable membrane barrier containing a majority of the nucleation crystals to the solution that is introduced to the high pressure side of the first semi-permeable membrane barrier.

2. The method of claim 1 further comprising the step:

(d) returning a majority fraction of the second retentate stream rejected by the second semi-permeable membrane barrier to the solution that is introduced into the high pressure side of the first semi-permeable membrane barrier.

3. The method of claim 1 wherein the initial solution is a heated saline solution.

4. The method of claim 1 wherein a portion of the solution introduced to the high pressure side of the first semi-permeable membrane barrier in step (a) is bypassed around the first semi-permeable membrane

barrier and is introduced to the high pressure side of the second semi-permeable membrane barrier.

5. The method of claim 1 wherein a majority fraction of the retentate stream rejected by the first semi-permeable membrane barrier containing a majority of the nucleation crystals is desupersaturated before said stream is returned to the solution introduced to the high pressure side of the first semi-permeable membrane barrier.

6. The method of claim 1 wherein the first semi-permeable membrane barrier is a nanofiltration membrane.

7. The method of claim 1 wherein the second semi-permeable membrane barrier is a reverse osmosis membrane.

8. The method of claim 1 wherein the first semi-permeable membrane barrier is contained in tubular membrane modules.

9. The method of claim 1 wherein the second semi-permeable membrane barrier is contained in spiral-wound membrane elements.

10. The method of claim 1 wherein the sparingly soluble solutes in the initial solution include calcium, sulfate and silica.

11. The method of claim 1 wherein the nucleation crystals in the solution of step (a) which is added to the high pressure side of the first semi-permeable membrane barrier are added to the solution upon startup, and are selected from the group consisting of calcium sulfate, calcium carbonate, calcium phosphate, and silica.

12. The method of claim 1 wherein the initial solution is a saline solution comprised of water containing between 3,000 and 20,000 mg/L of total dissolved solids.

13. The method of claim 1 wherein the solution produced on the low pressure side of the second semi-permeable membrane barrier is water containing less than 500 mg/L of total dissolved solids.

14. The method of claim 1 wherein the water content of the product stream produced on the low pressure side of the second semi-permeable membrane barrier is greater than or equal to 80% of the water content of the

solution introduced to the high pressure side of the first semi-permeable membrane barrier.

15. The method of claim 1 wherein the solution introduced to the high pressure side of the first semi-permeable membrane barrier is agricultural drainage water.

16. The method of claim 1 wherein the solution introduced to the high pressure side of the first semi-permeable membrane barrier is groundwater.

17. The method of claim 1 wherein the solution introduced to the high pressure side of the first semi-permeable membrane barrier is a brine stream produced in a separate water treatment process.

18. A method of desalinating a saline solution containing sparingly soluble solutes comprising the steps of:

(a) introducing a saline solution containing sparingly soluble solutes and nucleation crystals to the high pressure side of a first semi-permeable membrane barrier to produce a retentate stream on the high pressure side of the first semi-permeable membrane barrier, and a permeate solution on the low pressure side of the first semi-permeable membrane barrier containing reduced concentrations of the sparingly soluble solutes;

(b) introducing the permeate solution produced on the low pressure side of the first semi-permeable membrane barrier to the high pressure side of a second semi-permeable membrane barrier to produce a second retentate stream on the high-pressure side of the second semi-permeable membrane barrier, and a product solution on the low pressure side of the second semi-permeable membrane barrier with substantially lower concentrations of sparingly soluble and soluble solutes compared to the saline solution initially introduced in step (a);

(c) separating the retentate stream rejected by the first semi-permeable membrane barrier into a majority fraction solution containing a majority of the nucleation crystals and a minority fraction solution containing a minority of the nucleation crystals;

(d) returning the majority fraction solution directly to the saline solution that is introduced to the high pressure side of the first semi-permeable membrane barrier;

(e) separating the minority fraction solution into: (i) a first-fraction solution with a higher level of suspended solids, and (ii) a second-fraction solution with a lower level of suspended solids;

(f) returning a portion of the first-fraction solution with a higher level of suspended solids to the saline solution that is introduced to the high pressure side of the first semi-permeable membrane barrier; and

(g) returning the second retentate stream to the saline solution that is introduced to the high pressure side of the first semi-permeable membrane barrier.

19. The method of claim 18 wherein the separation of the minority fraction solution in step (e) is accomplished using a gravity settling tank, centrifuge, hydrocyclone or filter.

20. The method of claim 18 wherein the first-fraction solution with a higher level of suspended solids is further split into (i) a discharge fraction and (ii) a recovery fraction with the recovery fraction being returned and introduced into the saline solution that is introduced into the high pressure side of the first semi-permeable membrane barrier.

21. The method of claim 18 wherein the second-fraction solution with a lower level of suspended solids is further split into (i) a discharge fraction and (ii) recovery fraction with said recovery fraction being returned and introduced into the saline solution that is introduced into the high pressure side of the first semi-permeable membrane barrier.

22. The method of claim 18 wherein a fraction of the discharge fraction is combined with the product stream produced on the low pressure side of the second semi-permeable membrane barrier to effect a reduction in the agronomic sodium adsorption ratio of said solution.

23. The method of claim 18 wherein the initial saline solution is heated.

24. The method of claim 18 wherein saline solution is introduced into the high pressure side of the second semi-permeable membrane barrier which does not pass through the first semi-permeable membrane barrier.

25. The method of claim 18 wherein the retentate stream rejected by the first semi-permeable membrane barrier containing a majority of the nucleation crystals is desupersaturated before the solution is returned to the high pressure side of the first semi-permeable membrane barrier.

26. The method of claim 18 wherein the first semi-permeable membrane barrier is selected from the class of nanofiltration membranes.

27. The method of claim 18 wherein the second semi-permeable membrane barrier is selected from the class of reverse osmosis membranes.

28. The method of claim 18 wherein the first semi-permeable membrane barrier is contained in tubular membrane modules.

29. The method of claim 18 wherein the second semi-permeable membrane barrier is contained in spiral-wound membrane elements.

30. The method of claim 18 wherein the sparingly soluble solutes in the initial saline solution are calcium sulfate and silica.

31. The method of claim 18 wherein the seed nucleation crystals added upon startup are selected from the group of calcium sulfate, calcium carbonate, calcium phosphate, and silica.

32. The method of claim 18 wherein the initial saline solution is water containing between 3,000 and 20,000 mg/L of total dissolved solids.

33. The method of claim 18 wherein the solution produced on the low pressure side of the second semi-permeable membrane barrier is water containing less than 500 mg/L of total dissolved solids.

34. The method of claim 18 wherein the water content of the solution produced on the low pressure side of the second semi-permeable membrane barrier is greater than or equal to 80% of the water content of the initial saline solution.

35. The method of claim 18 wherein the initial saline solution is agricultural drainage water.

36. The method of claim 18 wherein the initial saline solution is groundwater.

37. The method of claim 18 wherein the initial saline solution is the brine stream produced in a separate water treatment process.

38. A system for desalinating a solution containing soluble and sparingly soluble solutes comprising:

(a) a first semi-permeable membrane barrier having a high-pressure side and a low-pressure side for receiving a feed stream on the high-pressure side and producing:

a permeate stream on the low-pressure side having reduced concentrations of sparingly soluble solutes as compared to the feed stream, and

a first retentate stream on the high-pressure side;

(b) a second semi-permeable membrane barrier having a low pressure side and a high-pressure side in fluid communication with, and downstream of, the first semi-permeable membrane for receiving the permeate stream on the high-pressure side and producing:

a second retentate stream on the high-pressure side, and

a product water stream on the low-pressure side having substantially lower concentrations of sparingly soluble and soluble solutes compared to the feed stream; and

(c) means for separating solids from the first retentate stream into a first fraction solution having a higher level of suspended solids and a second fraction solution with a lower level of suspended solids, said solid separating means in fluid communication with the high-pressure side of the first semi-permeable membrane.

39. The system of claim 38 wherein said separating means is selected from the group consisting of: a gravity settling tank, a centrifuge, a hydrocyclone and a filter.

40. The system of claim 38 further comprising means for joining a stream from the solid separating means and a stream from the high-pressure side of the second semi-permeable membrane with the feed stream.

41. The system of claim 38 further comprising:

(d) means for separating the first retentate stream into a majority fraction solution and a minority fraction solution upstream of said solid-separating means, wherein said minority fraction solution is in fluid communication with said solid separating means and said majority fraction solution is in fluid communication with said high-pressure side of said first semi-permeable membrane barrier.

42. The system of claim 38 further comprising:

(d) means for passing a portion of the feed stream directly to the high-pressure side of the second semi-permeable membrane.

43. The system of claim 38 further comprising:

(d) means for heating the feed stream.

44. The system of claim 38 further comprising means for splitting said first fraction solution into a high-solid recycle stream and a high-solid discharge stream.

45. The system of claim 38 including means for splitting said second fraction solution into a low-solid recycle stream and a low-solid discharge stream.

46. The system of claim 41 further including desupersaturating means to receive said majority fraction solution and said second fraction solution.

47. The system of claim 46 wherein said desupersaturating means is a stirred vessel.

48. The system of claim 44 further including adjustment means for controlling the agronomic sodium absorption ratio of said product water stream, said adjustment means allowing a controlled amount of said high-solid discharge stream to be added to said product water stream.